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GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC,  
LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW,  
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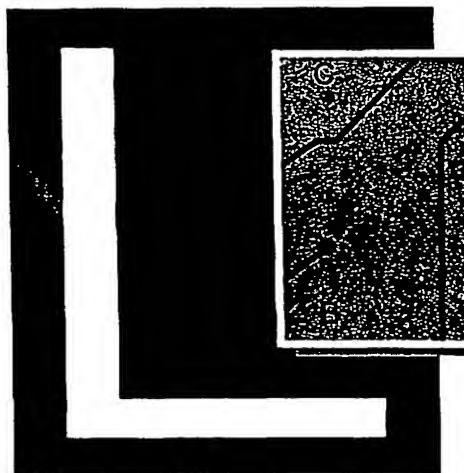
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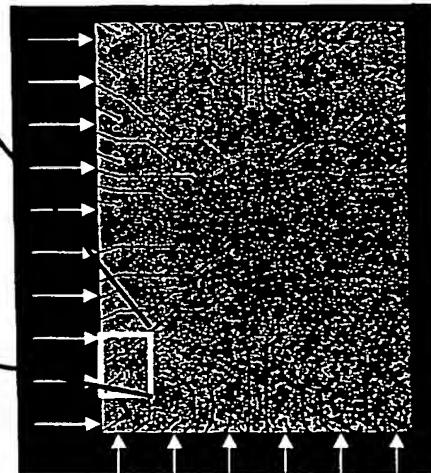
[Continued on next page]

(54) Title: METHOD AND DEVICE FOR IMAGE PROCESSING AND LEARNING WITH NEURONAL CULTURES

A



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(57) Abstract: It is disclosed a device for image processing and learning comprising at least a "multi electrode array" (MEA), over which an homogeneous culture of interconnected neurons, so that forming a cell network, is grown on, wherein said MEA is able to stimulate and record the electric activity of said neurons. Methods for image processing and learning utilizing the device are disclosed too.



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International Application No

PCT/IT 03/00317

**A. CLASSIFICATION OF SUBJECT MATTER**

IPC 7 G06N3/06

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 G06N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EGGERS M D ET AL: "ELECTRONICALLY WIRED PETRI DISH: A MICROFABRICATED INTERFACE TO THE BIOLOGICAL NEURONAL NETWORK" JOURNAL OF VACUUM SCIENCE AND TECHNOLOGY: PART B, AMERICAN INSTITUTE OF PHYSICS. NEW YORK, US, vol. 8, no. 6, 1 November 1990 (1990-11-01), pages 1392-1398, XP000169149 ISSN: 1071-1023 page 1392 - page 1398 -----	1
A	-----	2,6 -/-

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

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## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	BUITENWEG J R ET AL: "FINITE ELEMENT MODELING OF THE NEURON-ELECTRODE CONTACT" November 2000 (2000-11), IEEE ENGINEERING IN MEDICINE AND BIOLOGY MAGAZINE, IEEE INC. NEW YORK, US, PAGE(S) 46-52 , XP000975448 ISSN: 0739-5175 page 46 – page 52 -----	1
A	EP 1 104 911 A (UNIV CALIFORNIA) 6 June 2001 (2001-06-06) -----	2,6
A		

**INTERNATIONAL SEARCH REPORT**

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Patent document cited in search report	Publication date		Patent family member(s)	Publication date
EP 1104911	A	06-06-2001	EP 1104911 A2	06-06-2001
			EP 1104912 A2	06-06-2001
			EP 1104913 A2	06-06-2001
			AT 208514 T	15-11-2001
			AU 7717194 A	21-03-1995
			DE 69429006 D1	13-12-2001
			DE 69429006 T2	18-07-2002
			EP 0715737 A1	12-06-1996
			ES 2167378 T3	16-05-2002
			JP 9505161 T	20-05-1997
			WO 9506288 A2	02-03-1995
			US 5717834 A	10-02-1998

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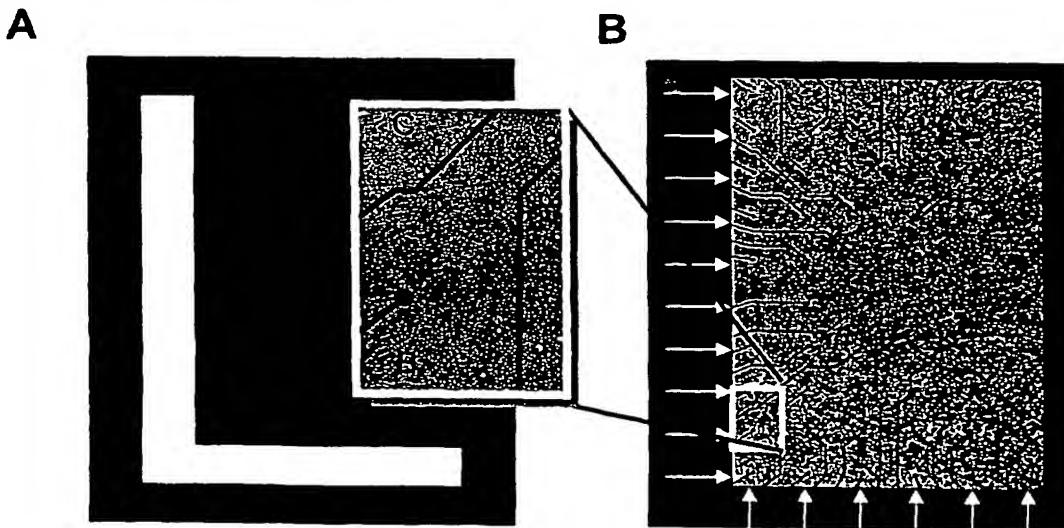
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29 November 2002 (29.11.2002) IT
- (71) Applicant (*for all designated States except US*): S.I.S.S.A. SCUOLA INTERNAZIONALE SUPERIORE DI STUDI AVANZATI [IT/IT]; Via Beirut, 2-4, I-34014 Trieste (IT).
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- I-34014 Trieste (IT). TORRE, VIncent [IT/IT]; S.I.S.S.A. Scuola Internazionale Superiore di Studi, i Avanzati, Via Beirut, 2-4, I-34014 Trieste (IT).
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